VIRTUAL PLANNING AS A RESOURCE FOR CORRECTING SEVERE FACIAL ASYMMETRY – CASE REPORT

Planejamento virtual como recurso para correção de assimetria facial severa – relato de caso

Access this article online	
Quick Response Code:	**Website:** https://periodicos.uff.br/ijosd/article/view/60711
	DOI: 10.22409/ijosd.v1i66.60711

Autores:
Kleber Vinícius Rodrigues dos Santos
Implantodontista e Doutorando em Ciências pela Universidade de São Paulo – USP.

Gustavo Martins Gontijo
Implantodontista e Cirurgião-dentista pela Faculdade de Odontologia da Universidade Federal de Goiás – UFG.

Alexandre Alves Leite
Cirurgião Bucomaxilofacial pela Universidade do Sagrado Coração, Bauru, São Paulo.

Instituição na qual o trabalho foi realizado: Universidade de São Paulo – USP.

Endereço para correspondência: Avenida do Café, s/n, Campus da USP, Ribeirão Preto, São Paulo, 140040-904, Goiânia, Goiás. (62) 985640032
E-mail para correspondência: klebervinicius@live.com

RESUMO

A hiperplasia hemimandibular é responsável por prejuízos estéticos, funcionais, motores e psicossociais. Com etiologia incerta, ocorre frente ao desequilíbrio de fatores regulatórios de crescimento presentes na camada cartilaginosa do côndilo. O relato objetiva descrever a tomada de decisões baseada em exames complementares específicos aliados à adequada intervenção cirúrgica da lesão.

Paciente gênero feminino, 33 anos de idade, compareceu à clínica particular com queixa principal de “face assimétrica”, foi requerido uma avaliação cintilográfica objetivando e confirmando a interrupção do crescimento condilar, descartando a hipótese de Osteocondroma e condilectomia. Após preparo ortodôntico prévio, os exames tomográficos foram utilizados na criação de um protótipo que foi impresso após a realização dos movimentos ósseos planejados. Mediante à reconstrução, foi concluído que a assimetria presente não seria totalmente corrigida somente através da intervenção ortognática, sendo necessária também uma osteotomia removendo parte da base do corpo e ângulo mandibular, através da confecção de um guia de corte, promovendo à reanatomização sem a necessidade de acesso extra oral submandibular, evitando uma cicatriz em face feminina. Paciente encontra-se em pós-operatório de 60 meses, sem queixas e satisfeita. Portanto, é evidenciado cada vez mais a influência positiva que o planejamento virtual pode trazer aos profissionais na otimização dos resultados cirúrgicos.

Palavras-chave: hiperplasia, assimetria facial,cintilografia, côndilo mandibular.

ABSTRACT

Hemimandibular hyperplasia is responsible for aesthetic, functional, motor, and psychosocial impairments. With an uncertain etiology, it occurs due to the imbalance of regulatory growth factors present in the cartilaginous layer of the condyle. The report aims to describe decision-making based on specific complementary exams combined with the appropriate surgical intervention for the condition. A 33-year-old female patient presented at a private clinic with the main complaint of "asymmetric face." A scintigraphic evaluation was requested to objectively confirm the interruption of condylar growth, ruling out the hypothesis of Osteochondroma and condylectomy. After prior orthodontic preparation, tomographic exams were used to create a prototype that was printed after planned bone movements. Through the reconstruction, it was concluded that the existing asymmetry would not be entirely corrected through orthognathic intervention alone, necessitating also an osteotomy to remove part of the base of the body and mandibular angle. This was done through the creation of a cutting guide, allowing for reanatomization without the need for submandibular extraoral access, thus avoiding a scar on the female face. The patient is 60 months postoperative, with no complaints and satisfied. Therefore, the increasingly positive influence of virtual planning on optimizing surgical outcomes for professionals is evident.

Keywords: hyperplasia; facial asymmetry; scintilography; mandibular condyle.

INTRODUCTION

Hemimandibular hyperplasia is an asymmetric mandibular malformation with an unclear etiology and epidemiology. It typically occurs before puberty and is responsible for aesthetic, functional, motor, and psychosocial impairments in individuals (MARCHETTI et al. 2000; NELKE et al. 2018).

This anomaly is characterized by the three-dimensional enlargement of the condyle, ramus, and mandibular body (SUN et al 2019). Clinically, patients exhibit mentum (chin) deviation to the unaffected side, and asymmetry of the lower border of the mandible is observed in the majority of patients (XU et al. 2014). Its diagnosis is precise and specific, featuring a lower convexity of the mandibular lower border and downward displacement of the mandibular canal (SUN et al 2019).

The abnormal growth appears to receive stimulation from within the fibrocartilaginous layer or is produced by it. Different histological patterns have been observed within the condylar growth zone in this malformation. This excessive mandibular growth is classified as condylar hyperplasia, excessive mandibular growth with differentiated displacement from the normal mandibular shape, hemimandibular elongation characterized by elongation and slender mandibular body without an increase in height on the affected side. Hemimandibular hyperplasia, on the other hand, involves an increase in the height of the mandibular body and ramus (OBWEGESER et al. 1986).

Nelke *et al.* (2018) conducted a ten-year follow-up study with Polish individuals, collecting epidemiological, geographical, and clinical data related to the occurrence and treatment protocols of hemimandibular hyperplasia and other mandibular malformations. In their study, women showed a higher prevalence of mandibular malformations (82-87%), and the first symptoms typically appeared between the ages of 13-15. The gender difference was statistically significant for both sides ($p<0.05$), with women being more demanding patients with higher expectations regarding surgery and treatment compared to men (NELKE et al. 2018).

Skeletal scintigraphy examinations are important and essential tools for estimating bone growth, contributing to surgical approach planning and predictability in the management of these malformations (NELKE et al. 2018; SILVEIRA & SCARFE 1995).

Complementary examinations are of fundamental importance for the diagnosis and treatment planning of hemimandibular hyperplasia (SUGAWARA et al.

2002). Three-dimensional reconstructions of structures within the dento-maxillofacial complex can be obtained through cone beam computed tomography and the use of specific software, ensuring precision in surgical planning and greater predictability. Thus, there is an increasing trend in the use of complementary examinations combined with virtual planning software and 3D printing, justifying the prominence of their use (FERGUSON, 2005; DINIZ et al. 2019; RIBAS et al. 2005).

The purpose of this case report is to describe decision-making based on specific complementary examinations combined with appropriate surgical intervention for the condition.

CASE REPORT

Female patient, 33 years old, melanoderm, ASA I, with no significant prior medical history, and an unremarkable family medical history. She sought a private clinic with the primary complaint of "asymmetric face, aesthetic concerns, and difficulty chewing properly." Following anamnesis, a physical examination was conducted, both intraoral and extraoral, revealing a slight midline deviation, increased vertical dimension on the left side, and severe facial asymmetry in the lower third of the face. Subsequently, complementary examinations were requested to aid in diagnosing and treating the primary complaint (Figures 1, 2 and 3).

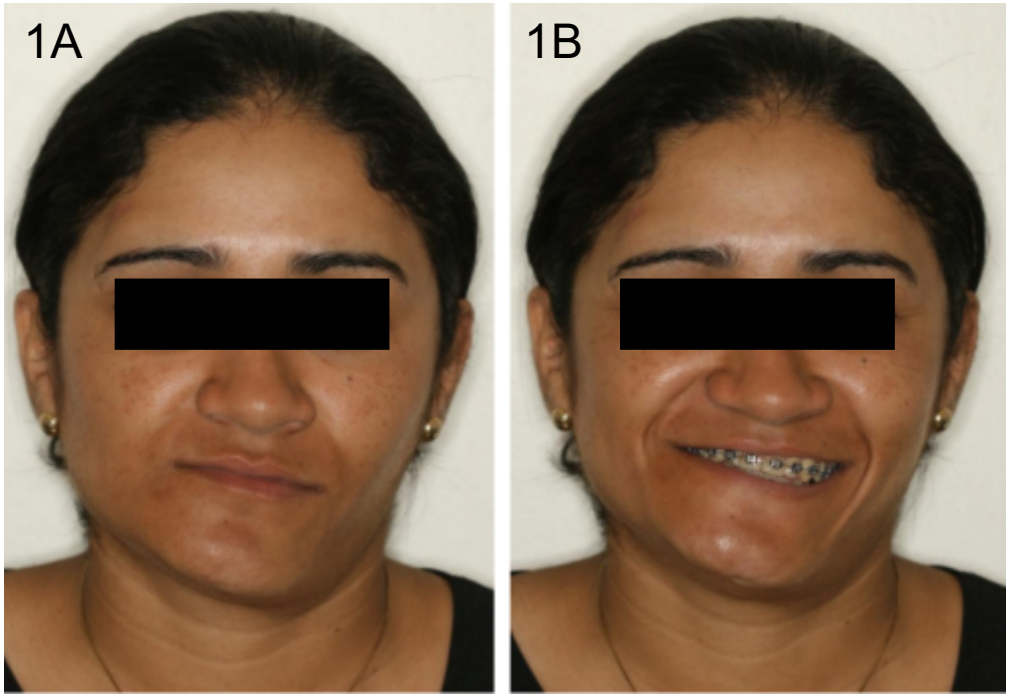

Figure 1: 1A frontal photograph of the patient with sealed lips. 1B frontal photograph patient smiling Note lower third of the face with great asymmetry, accentuated “cant”.

Figure 2: 2A profile photograph on the right side. 2B profile photograph left side. Note great asymmetry in the region of the mandibular angles, great asymmetry in height and contour.

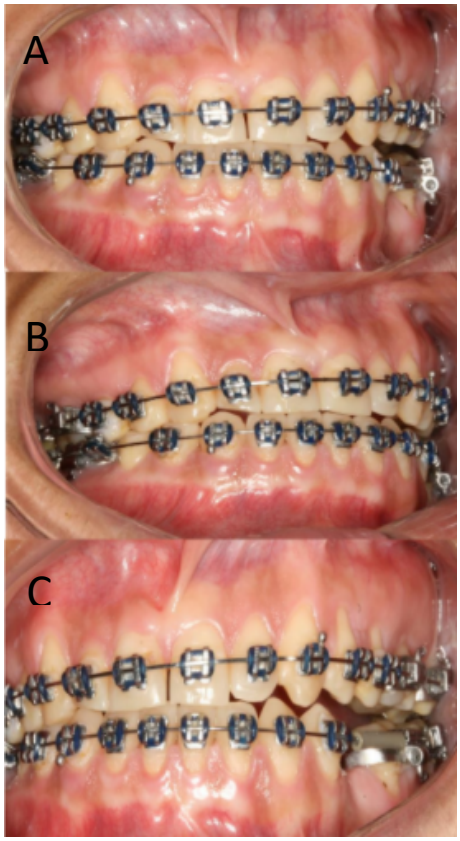

Figure 3: 3A frontal intra-oral photograph, 3B right-side intra-oral photograph, 3C left-side intra-oral photograph.

A scintigraphic assessment was requested to objectively confirm the interruption of condylar growth, ruling out the hypothesis of Osteochondroma, which, according to the World Health Organization, refers to bony projections covered by cartilage that protrude on the outer surface of the bone. The possibility of condylectomy was also excluded. The treatment goals aimed at correcting mastication, deglutition, respiration, facial aesthetics, and speech.

After prior orthodontic preparation, tomographic examinations were used to create a prototype, which was 3D-printed after virtual planning and the execution of the planned bone movements (Figure 4). The patient was in suitable health conditions to undergo the proposed surgical corrections, which were carried out under general anesthesia in a hospital setting in Goiânia, Goiás, Brazil. The procedures involved osteotomies, mobilizations, and repositioning.

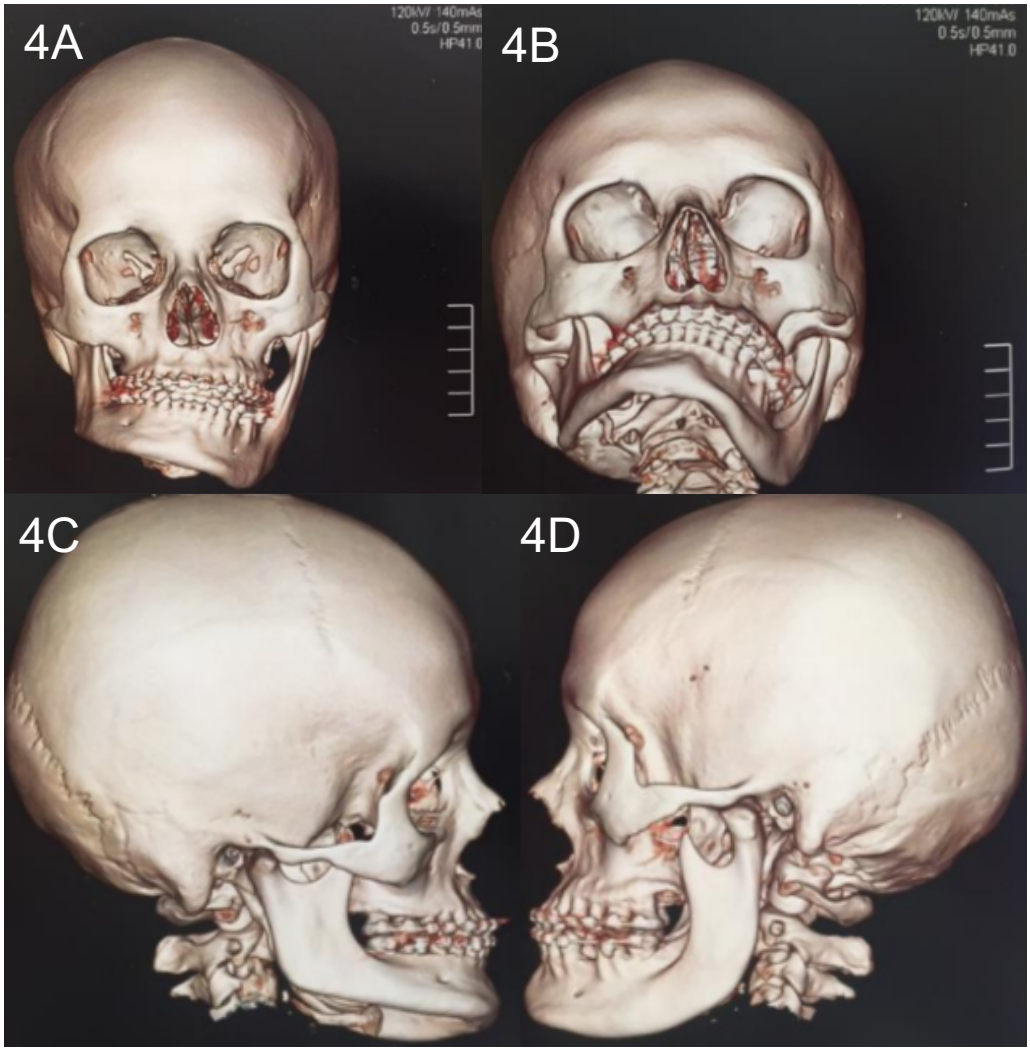

Figure 4: Three-dimensional reconstruction of the facial bones, 4A frontal, 4B posterior tilt, 4C right side, 4D left side.

Prototyped surgical guides for intermediate, palatal, final, and mentum are fixation devices for orthognathic surgery, representing the best available resource on the market to transfer the surgical planning to the surgical procedure. The following steps were followed in the making of these fixators: After obtaining a computed tomography scan, a 3D reconstruction of the facial skeleton and soft tissue volume of the face was conducted (rendering the scanned volume), creating what can be called a virtual patient (Figure 5).

Figure 5: Three-dimensional reconstruction of facial bones and soft tissues.

Using Blender 3D software version 2.78, with the OrtogOnBlender add-on (Blender Foundation - Amsterdam, the Netherlands), which is used for facial surgery planning, the case was planned and a virtual surgery was performed. This software allows the surgical procedure to be executed on the computer, accurately reproducing all surgical steps and providing a preview of the postoperative result.

Once the virtual surgery was completed, the files containing preoperative and postoperative information were sent to the clinic's own laboratory, responsible for modeling the surgical guide. The surgical guide is a device made of acrylic resin, individually manufactured for each patient using a 3D desktop printer, Ultimaker 2+ (Ultimaker, England), and the printing material used was biodegradable polymer. The surgical guide allows for the precise positioning of bone during the surgical procedure, exactly in the position planned by the surgeon. This tool enables the surgeon to have precision in bone placement during surgery, avoiding errors inherent to the traditional technique of planning with plaster models. This piece is customized for each surgical procedure, coming into contact only with the patient's teeth and is not implanted (SCHUCHARDT & BEITRAG, 1942; NOIA et al. 2011) (Figure 6).

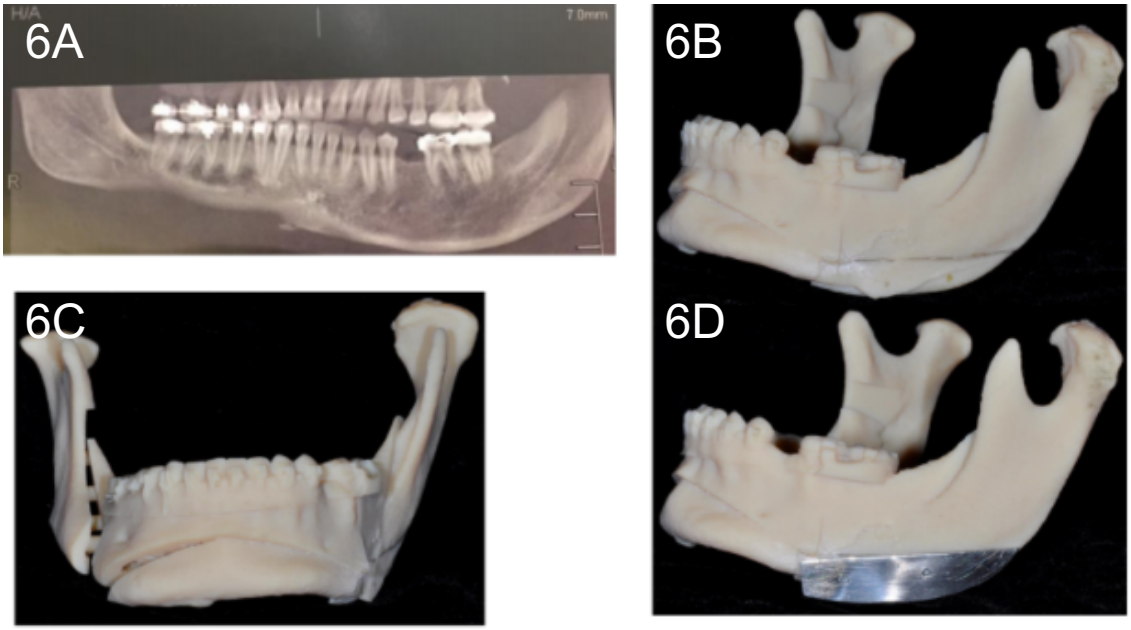

Figure 6: Models printed with a 3D printer and metal cutting guide.

Through virtual planning and 3D reconstruction, it was concluded that the existing asymmetry would not be fully corrected by orthognathic intervention alone. It was also necessary to perform a sagittal osteotomy, removing part of the base and mandibular angle of the patient (Figure 7).

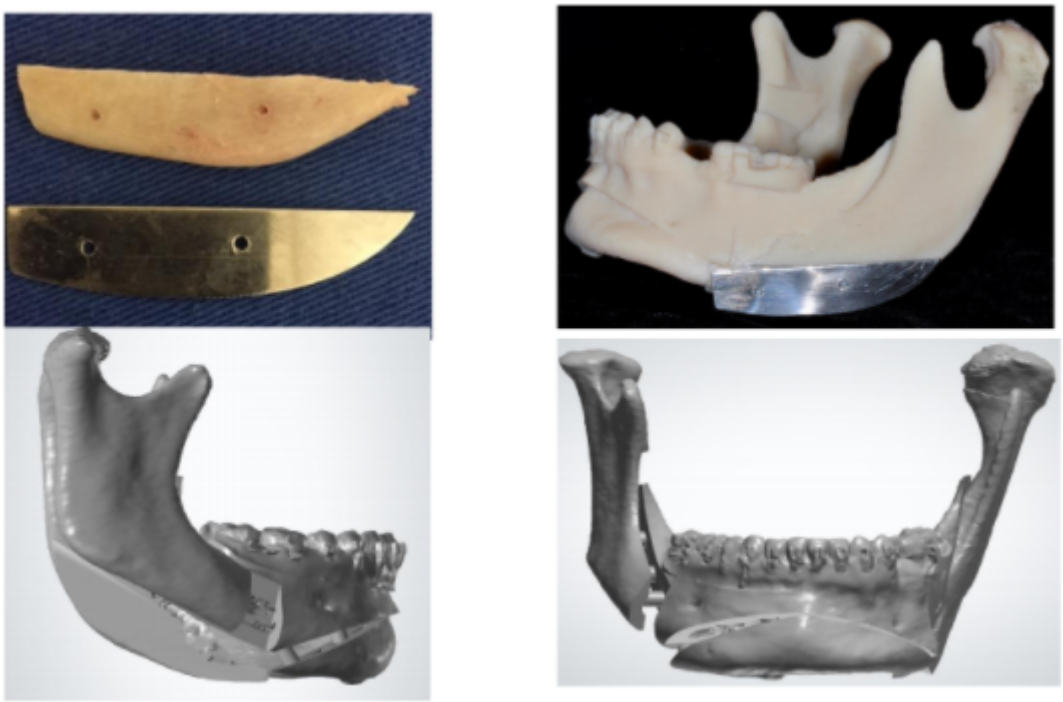

Figure 7: 7A bone fragment removed from the mandible and metal cutting guide, 7B 3D model with cutting guide installed, 7C mandible reconstruction in right side software, 7D mandible reconstruction software front view.

For the osteotomy technique, a metal plate surgical cutting guide was fabricated and pre-fixed to the mandible to guide the surgeon regarding the dimensions and the appropriate location for the osteotomy. This guide allows for reanatomization without the need for extra-oral submandibular access, thus avoiding an extra-oral scar on the female face. The patient is currently in the postoperative phase of 60 months, without any complaints, and is quite satisfied, especially with the aesthetic result obtained through the surgery (Figures 8, 9 and 10).

Figure 8: 8A pre-operative photo frontal view, 8B 4-month post-operative photo frontal view, 8C pre-operative photo in profile, 8B 4-month post-operative photo in profile.

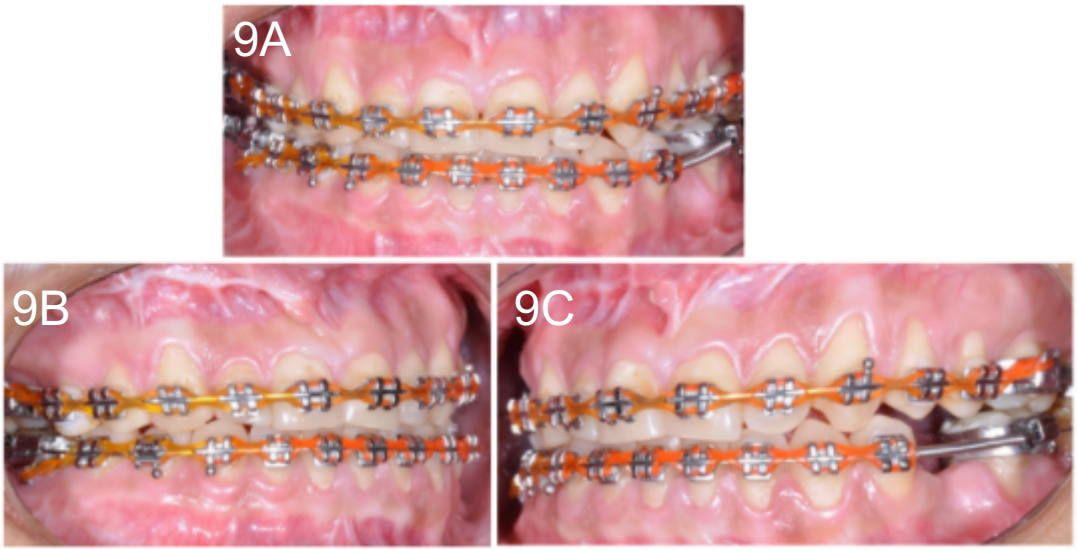

Figure 9: Occlusion 4 months after surgery, 9A frontal view, 9B direct side, 9C left side.

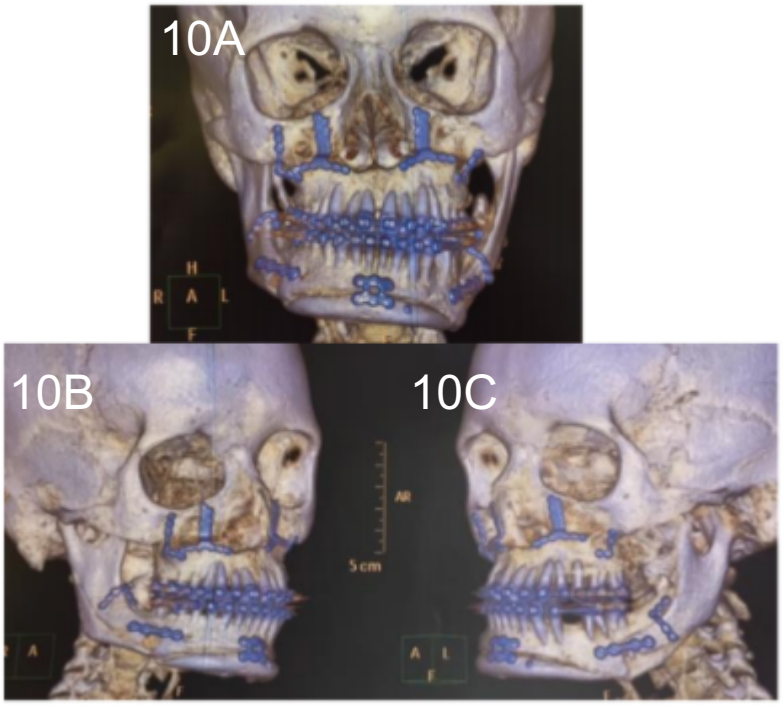

Figure 10: 3D reconstruction after surgery, 10A frontal view, 10B right side, 10C left side.

DISCUSSION

Orthognathic surgery is a surgical technique aimed at correcting maxillary (maxilla and mandible) deformities, bringing them into a position that allows for proper occlusion, facial balance, adequate airway patency, healthy

temporomandibular joints (TMJs), and periodontal health (GHAI et al. 2018; KRETTEK & BRUNS, 2019).

According to Sugawara *et al.* (2002), in a case of hemimandibular hyperplasia without excessive abnormal growth, orthognathic surgery preserving the hypertrophic condyle led to functional improvement, along with good occlusal and aesthetic outcomes. Similarly, in the present case, there was no need for high condylectomy, as confirmed by scintigraphy (JACOBS & LIN, 2017).

Ferguson (2005) stated that hemimandibular hyperplasia malformation can be surgically corrected with good aesthetic and functional results and minimal morbidity. In his work, it was also possible to overcome technical and anatomical challenges associated with correcting this hemimandibular deformity and achieve acceptable facial symmetry (LAL & PATRALEKH, 2018).

Diniz *et al.* (2019) conducted virtual planning, which allowed the preparation of prototyped surgical guides and utilized stereolithographic models for the production of acrylic guides for high condylectomy and contouring of the mandibular base. Orthognathic surgery resulted in maxillary repositioning, correction of the occlusal plane, reduction of the right mandibular branch and body, and Class I dental fixation. An acrylic guide was used at the base for mandibular contour osteotomy, and condylectomy was performed via an endaural approach. No recurrence was observed during a two-year follow-up (PARK & SHIN, 2018; ZOU et al. 2018). It is evident that advances in surgery associated with virtual planning and the 3D printing of prototyped guides provide greater predictability for the surgeon, leading to increased chances of a successful surgical outcome and, consequently, greater patient satisfaction, as reported by the patient in this case report.

In the present case report, the patient complained of "asymmetric face," and the healthcare professionals responsible for the case, armed with complementary examinations and virtual planning, achieved success in managing the clinical case, also enhancing the patient's aesthetic expectations of not having facial scarring post-surgery.

CONCLUSION

The approach to hemimandibular hyperplasia, with the supplemental contribution of digital planning, ensured greater predictability and safety during the surgical procedure, reduced intraoperative time as reported by the oral and maxillofacial surgeon, and verified the correct positioning of the bone segments. Therefore, it guarantees the optimization of surgical outcomes by reducing the likelihood of

postoperative sequelae that may require re-surgical intervention, among other potential complications.

REFERENCES

1. Marchetti C, Cocchi R, Gentile L, Bianchi A. Hemimandibular hyperplasia: treatment strategies. J Craniofac Surg. 2000;11(1):46-53.

2. Nelke KH, Pawlak W, Morawska-Kochman M, Łuczak K. Ten years of observations and demographics of hemimandibular hyperplasia and elongation. J Craniomaxillofac Surg. 2018;46(6):979-986.

3. Sun R, Sun L, Sun Z *et al*. A three-dimensional study of hemimandibular hyperplasia, hemimandibular elongation, solitary condylar hyperplasia, simple mandibular asymmetry and condylar osteoma or osteochondroma. J Craniomaxillofac Surg. 2019;47(11):1665-1675.

4. Xu M, Chan FC, Jin X, *et al*. Hemimandibular hyperplasia: classification and treatment algorithm revisited. J Craniofac Surg. 2014;25(2):355-358.

5. Obwegeser HL, Makek MS. Hemimandibular hyperplasia--hemimandibular elongation. J Maxillofac Surg. 1986;14(4):183-208.

6. Silveira AM, Scarfe WC. Three-dimensional CT scan of hemimandibular hyperplasia: case report. Braz Dent J. 1995;6(1):65-701.

7. Sugawara Y, Hirabayashi S, Susami T, Hiyama S. The treatment of hemimandibular hyperplasia preserving enlarged condylar head. Cleft Palate Craniofac J. 2002;39(6):646-654.

8. Ferguson JW. Correção cirúrgica definitiva da deformidade decorrente da hiperplasia hemimandibular. Journal of Cranio-maxillo-facial Surgery: Official Publication of the European Association for Cranio-maxillo-facial Surgery. Junho de 2005;33(3):150-157.

9. Diniz JA, Siqueira ADS, Torres LHS, Faro TF, Rodrigues EDR, Laureano Filho JR. Virtual Surgical Planning and One-Stage Treatment of Active Hemimandibular Hyperplasia. J Craniofac Surg. 2019;30(7):679-681.

10. Ribas MO, Reis LFG, França BHS, Lima AAS. Cirurgia ortognática: orientações legais aos ortodontistas e cirurgiões bucofaciais. R Dental Press Ortodon Ortop Facial. 2005;10(6):75-83.

11. Schuchardt GES. Beitrag zur chirurgischen kieferorthopadie unter berücksichtigunihrer für die behandlung angeborener und erworbener kieferdeformitäten bei soldaten. Dtsch Zahn Mund Kieferheilkd. 1942; 9: 73.

12. Noia CF, Ortega-Lopes R, Chaves-Neto HDM, Nascimento FAO, Mazzonetto R. Acidentes durante a realização da osteotomia sagital do ramo mandibular: relato de caso. Rev. Cir. Traumatol. Buco-maxilo-fac. 2011;11(1).

13. Ghai S, Sharma Y, Jain N, Satpathy M, Pillai AK. Use of 3-D printing technologies in craniomaxillofacial surgery: a review. Oral Maxillofac Surg. 2018;22(3):249-259.

14. Krettek C, Bruns N. Aktueller Stand und neue Entwicklungen des 3D-Drucks in der Unfallchirurgie [Current concepts and new developments of 3D printing in trauma surgery]. Unfallchirurg. 2019;122(4):256-269.

15. Jacobs CA, Lin AY. A new classification of threedimensional printing technologies: systematic review of threedimensional printing for patient-specific craniomaxillofacial surgery. Plast Reconstr Surg. 2017;139:1211–1220.

16. Lal H, Patralekh MK. 3D printing and its applications in orthopaedic trauma: a technological marvel. J ClinOrthopTrauma. 2018;9(3):260–268.

17. Park ME, Shin SY. Three-dimensional comparative study on the accuracy and reproducibility of dental castsfabricated by 3D printers. J Prosthet Dent. 2018;119(5):861–867.

18. Zou Y, Han Q, Weng X *et al*. The precision and reliability evaluation of 3-dimensional printed damaged bone and prosthesis models by stereolithography appearance. Medicine. 2018;97(6):97.